CLAIMS

We claim:

1. An inner conductor for use in a resonator, the inner conductor comprising an elongated conductive body with a flange formed on one end, wherein the flange is formed integrally with the conductive body in a process in which the end of the conductive body is pressed against a flanging tool such that the conductive body is sized and shaped so the flange provides a desired capacitance surface area when used in the resonator.

2. An inner conductor as defined in Claim 1, wherein the formed flange includes a planar transverse surface.

3. An inner conductor as defined in Claim 1, wherein the formed flange comprises a curved surface.

4. An inner conductor as defined in Claim 1, wherein the formed flange is curved backward on itself.

5. An inner conductor as defined in Claim 1, wherein the flanging tool is inserted within an open first end of a conductive body, wherein the conductive body is pressed over the flanging tool causing the first end of the conductive body to expand,

thereby producing a curved flange of a desired size and shape to achieve a desired capacitance surface area for use in a resonator.

6. An inner conductor as defined in Claim 5, wherein the flanging tool comprises:

a guiding tool having a hollow center in which the conductive body can be received;

an expanding tool that is configured to be inserted within the open first end of the conductive body; and

a calibration tool that cooperates with the expanding tool such that pressing the conductive body over the expanding tool causes the first end of the conductive body to expand into the calibration tool, thereby producing a flange having a desired size defined by a collar of the calibration tool such that the flange achieves a desired capacitance surface area when used in a coaxial resonator, wherein pressing the guiding tool on the flange produces a flange surface having a desired shape for the resonator.

7. An inner conductor as defined in Claim 6, wherein the calibration tool further includes a support that holds the expanding tool in position such that pressing the guiding tool onto the flange retracts the expanding tool into the calibration tool so that a desired shape of the flanged surface is achieved.

8. An inner conductor as defined in Claim 7, wherein the calibration tool further includes an annular disk, supported by a retractable support, wherein the annular

disk extends around the outer surface of the calibration tool and extends above an upper surface of the calibration tool so as to form a collar, and the annular disk retracts so that pressing the guiding tool onto the flange flattens the flange.

9. An inner conductor as defined in Claim 6, further comprising a flange that is formed on a second end of the conductive body.

10. An inner conductor as defined in Claim 6, wherein the conductive body has a generally cylindrical shape.

11. An inner conductor as defined in Claim 5, wherein the flanging tool comprises:

a guiding tool with a hollow center into which the conductive body can be placed;

an expanding tool that is configured to be inserted within the open first end of the conductive body; and

a calibration tool that cooperates with the expanding tool such that pressing the conductive body over the expanding tool causes the first end of the conductive body to expand into the calibration tool, thereby producing a flange of a desired size, and pressing the guiding tool onto the flange flattens the flange so that it achieves a desired flatness suitable for the resonator.

12. An apparatus for forming an inner conductor for use in a coaxial resonator, the apparatus comprising:

a flanging tool that is inserted within an open first end of a conductive body, wherein the conductive body is pressed over the flanging tool, causing the first end of the conductive body to expand outwardly, thereby producing a curved flange of a desired size and shape to achieve a desired capacitance surface area for use in a resonator.

13. An apparatus as defined in Claim 12, further including a flanging fixture with an array of the flanging tools.

14. An apparatus as defined in Claim 12, wherein the flanging tool comprises:

a guiding tool with a hollow center wherein the conductive body can be placed within the hollow center;

an expanding tool that is configured to be inserted within the open first end of the conductive body; and

a calibration tool that cooperates with the expanding tool such pressing the conductive body over the expanding tool causes the first end of the conductive body to expand into the calibration tool, thereby producing a flange having a desired size defined by a collar of the calibration tool such that the flange achieves a desired capacitance surface area when used in a coaxial resonator, wherein the guiding tool can be pressed on the flange to achieve a desired shape of the flange surface.

15. An apparatus as defined in Claim 12, wherein the apparatus forms a flange on a second end of the conductive body.

16. An apparatus as defined in Claim 12, wherein the conductive body has a generally cylindrical shape.

17. A coaxial resonator comprising:

a cavity having side walls and a top wall and a bottom wall;

a conductive body within the cavity, wherein the conductive body has two ends, a first end of the conductive body coupled to the bottom cavity wall and a second end facing the top cavity wall, wherein a flange on the second end of the conductive body is formed integrally with the conductive body in a process in which the end of the conductive body is pressed against a flanging tool such that the conductive body is sized and shaped so the flange provides a desired capacitance surface area when used in the resonator.

18. A coaxial resonator as defined in Claim 17, wherein the flange forming process further includes inserting a flanging tool within an opening in the second end of the conductive body, wherein the conductive body is pressed over the flanging tool, thereby causing the second end of the conductive body to expand and thereby producing a curved flange of a desired size and shape that provides a desired capacitance surface area for us in a resonator.

19. A coaxial resonator as defined in Claim 18, wherein the resonator includes a plurality of conductive bodies and the conductive bodies are formed with an array of flanging tools on a flanging fixture.

20. A coaxial resonator as defined in Claim 18, wherein the flange comprises a planar surface.

21. A coaxial resonator as defined in Claim 20, wherein the flanging tool with which the resonator is formed comprises:

a guiding tool with a hollow center wherein the conductive body is placed within the hollow center;

an expanding tool that is inserted within an opening in the second end of the conductive body; and

a calibration tool that cooperates with the expanding tool such that pressing the conductive body over the expanding tool causes the second end of the conductive body to expand into the calibration tool, thereby producing a flange having a desired size defined by a collar of the calibration tool such that the flange achieves a desired capacitance surface area when used in a coaxial resonator, wherein pressing the guiding tool on the flange produces a flange surface having a desired shape for the resonator.

22. A coaxial resonator as defined in Claim 18, wherein a flange is formed on a second end of the conductive body.

23. A coaxial resonator as defined in Claim 18, wherein the conductive body is generally cylindrical.

24. A coaxial resonator as defined in Claim 18, wherein the conductive body is an extrusion.

25. A coaxial resonator as defined in Claim 18, wherein the conductive body is constructed from copper.

26. A coaxial resonator as defined in Claim 18, wherein the conductive body is constructed from soft steel.

27. A coaxial resonator as defined in Claim 18, wherein the conductive body is constructed from brass.

28. A coaxial resonator as defined in Claim 18, wherein the conductive body is constructed from aluminum.

29. A method of making a coaxial resonator, the method comprising:

inserting a plurality of conductive bodies into holes of cavities in a resonator housing, wherein the cavities have side walls and a bottom wall, the holes are located in the bottom wall of the resonator housing, and each of the conductive bodies protrude into the cavities;

placing the resonator housing and conductive bodies onto a flanging fixture, wherein the flanging fixture comprises a plurality of flanging tools arranged so that one of the flanging tools align with each of the plurality of conductive bodies,

wherein the flanging tools are inserted within an opening in the protruding end of the each of the corresponding conductive bodies;

pressing the resonator body so that the plurality of conductive bodies are pressed over the flanging tools causing the protruding end of each of the conductive bodies to expand, thereby producing a curved flange of a size and shape to achieve a desired capacitance surface area for use in the resonator;

removing the press and leaving the resonator housing and plurality of conductive bodies on the flanging fixture;

inserting a plurality of clamping bushings into opening ends of the plurality of conductive bodies that are in the base of the resonator housing;

pressing a riveting tool head into each of the corresponding plurality of clamping bushings so that the plurality of clamping bushings attach the plurality of conductive bodies to the base of the resonator.

30. A method as defined in Claim 29, wherein the plurality of conductive bodies comprise multiple shapes.

31. A method as defined in Claim 30, wherein the plurality of conductive bodies comprise multiple lengths from the base of the resonator to the flanged end of the respective conductive bodies.

32. A flanging fixture for use in making a coaxial resonator, the flanging fixture comprising:

a base; and

a plurality of flanging tools arranged in a desired pattern on the base, wherein the flanging tools are of a size and shape so as to produce desired flange shapes on ends of inner conductors in a resonator and the flanging tools are a desired height so as to produce a desired length of the inner conductor from a base of the resonator.

33. A method of making a flanged body for use in a resonator, the method comprising:

placing a conductive body, having a hollow center, within a guiding tool;

inserting a first end of an expanding tool within the hollow center of the conductive body, the expanding tool first end having a first diameter and a second end of the expanding tool having a second diameter, wherein the second diameter is larger than the first diameter and a surface extends from the first diameter to the second diameter; and

forming a flange on a first end of the conductive body by pressing the conductive body over the expanding tool, causing the first end of the conductive body to expand into a flanging fixture to produce a flange of a desired size to achieve a desired capacitance surface area for use in a resonator.

34. A method as defined in Claim 33, wherein the conductive body further includes a second end, the method further comprising:

inserting an expanding tool and forming a flange on the second end of the conductive body.

35. A method as defined in Claim 33, further comprising attaching the conductive body to an internal surface of a cavity of a resonator.

36. A method as defined in Claim 33, wherein the flanging fixture further comprises a collar wherein the collar controls the shape and size of the flange.

37. A method as defined in Claim 33, wherein the conductive body is generally cylindrical.

38. A method as defined in Claim 33, wherein the conductive body is an extrusion.

39. A method as defined in Claim 33, wherein the conductive body is constructed from copper.

40. A method as defined in Claim 33, wherein the conductive body is constructed from soft steel.

41. A method as defined in Claim 33, wherein the conductive body is constructed from brass.

42. A method as defined in Claim 33, wherein the conductive body is constructed from aluminum.

43. An inner conductor for use in a resonator, the inner conductor comprising an elongated conductive body with a flange formed on one end, wherein the flange is

formed integrally with the conductive body in a process in which the end of the conductive body is pressed against a flanging tool and the flange is trimmed to be sized and shaped so the flange provides a desired capacitance surface area when used in the resonator.

44. An inner conductor as defined in Claim 43, wherein the formed flange includes a transverse planar surface.

45. An inner conductor as defined in Claim 43, wherein the formed flange comprises a curved surface.

46. An inner conductor as defined in Claim 43, wherein the formed flange is curved backward on itself.

47. An inner conductor as defined in Claim 43, wherein the flange forming process further includes inserting the flanging tool within an open first end of a conductive body, wherein pressing the conductive body over the flanging tool causes the first end of the conductive body to expand, thereby producing a curved flange of a desired size and shape to achieve a desired capacitance surface area for use in the resonator.

48. An apparatus for forming an inner conductor for use in a coaxial resonator, the apparatus comprising:

a guiding tool with a hollow center in which the conductive body can be placed;

an expanding tool that is configured to be inserted within the open first end of the conductive body; and

a calibration tool that cooperates with the expanding tool such that pressing the conductive body over the expanding tool causes the first end of the conductive body to expand into the calibration tool, thereby producing a flange of a desired size, and pressing the guiding tool onto the flange flattens the flange so that it achieves a desired flatness suitable for the resonator.

49. An apparatus as defined in Claim 48, further including a punch that trims the flange to a desired shape suitable for the resonator.

50. An apparatus as defined in Claim 49, wherein the guiding tool and punch are configured such that pressing the guiding tool so the flange has a desired flatness and trimming the flange with the punch are performed in a single operation.

51. An apparatus as defined in Claim 50, wherein the guiding tool and the punch are a single tool.